Supplementary

Table S1 Assessment of reproducibility and accuracy

	Insert 1	Insert 2	Insert 3	Insert 4	Insert 5
Brilliance					
BMD (mg/cm^3)	105.28±0.90	201.47±1.96	387.71±2.57	593.73±0.89	802.24±1.88
CV (%)	0.86	0.97	0.66	0.15	0.23
RE (%)	6.56±0.91	−0.21±0.97	−0.72±0.66	−0.90±0.15	1.08±0.24
Revolution					
BMD (mg/cm^3)	100.62±1.29	198.05±0.97	387.18±1.43	600.43±0.89	796.74±1.01
CV (%)	1.28	0.49	0.37	0.15	0.13
RE (%)	1.84±1.31	−1.91±0.48	−0.85±0.37	0.22±0.15	0.38±0.13

The exact value of inserts 1–5 was 98.8, 201.9, 390.5, 599.1, and 793.7 mg/cm^3 hydroxyapatite (HAP), respectively. Bone mineral density (BMD) and relative error (RE) are expressed as mean ± SD. CV, coefficient of variation.

Table S2 Relationship between QCT-derived BMD and dual-energy CT-derived BMD

Subgroups	Base material pairs	N	R	R^2_{adj}	β	c	P	NMSE (%), mean (95% CI)	RE_{linear} (%), mean (95% CI)	RE_{direct} (%), mean (95% CI)
All (participant level)	Ca (Wa)	128	0.992	0.985	2.630	−12.652	<0.001	1.8 (1.2–2.4)	0.7 (−0.6–2.0)	−56.7 (−57.6–−55.8)
	HAP(Wa)	128	0.993	0.985	1.235	−12.801	<0.001	1.8 (1.2–2.4)	0.7 (−0.6–2.1)	−63.2 (−64.0–−62.5)
	Ca (Fat)	128	0.993	0.987	2.574	−57.940	<0.001	1.6 (1.1–2.1)	0.6 (−0.6–1.9)	−37.5 (−40.3–−34.7)
	HAP(Fat)	128	0.993	0.987	1.234	−58.817	<0.001	1.6 (1.1–2.1)	0.6 (−0.6–1.9)	−47.8 (−50.1–−45.4)
L1 (vertebral level)	Ca (Wa)	128	0.991	0.983	2.593	−10.649	<0.001	2.1 (1.5–2.7)	0.8 (−0.5–2.0)	−57.0 (−57.8–−56.3)
	HAP(Wa)	128	0.991	0.983	1.218	−11.038	<0.001	2.1 (1.4–2.7)	0.7 (−0.6–2.0)	−63.4 (−64.1–−62.8)
	Ca (Fat)	128	0.992	0.984	2.538	−55.341	<0.001	1.9 (1.3–2.4)	0.7 (−0.6–1.9)	−38.5 (−40.9–−36. 0)
	HAP(Fat)	128	0.992	0.984	1.219	−56.479	<0.001	1.9 (1.3–2.5)	0.7 (−0.5–1.9)	−48.6 (−50.6–−46. 5)
L2 (vertebral level)	Ca (Wa)	128	0.992	0.984	2.653	−13.888	<0.001	2.0 (1.3–2.7)	0.8 (−0.7–2.4)	−56.2 (−57.4–−55.0)
	HAP(Wa)	128	0.992	0.985	1.245	−13.835	<0.001	2.0 (1.3–2.6)	0.9 (−0.6–2.4)	−62.8 (−63.8–−61.8)
	Ca (Fat)	128	0.993	0.987	2.599	−59.673	<0.001	1.7 (1.1–2.3)	0.8 (−0.7–2.1)	−35.7 (−39.5–−31.8)
	HAP(Fat)	128	0.993	0.987	1.245	−60.300	<0.001	1.7 (1.1–2.3)	0.7 (−0.7–2.1)	−46.3 (−49.5–−43.0)

QCT, quantitative computed tomography; BMD, bone mineral density; N, sample size; R^2_{adj}, adjusted R-square; β, coefficient of the linear formula; c, intercept of the linear formula; NMSE, normalized mean squared error; RE, relative error.

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Supplementary Material A1 Sample size consideration

For linear regression, the rule of thumb usually adopted is that the sample size should be no less than 5–20-fold the number of variables (37). In our study, the number of variables was 1, and all the sample sizes were 128; thus, the sample sizes of our study were far more than the minimum sample size required.

Supplementary Material A2 Radiation exposure dose consideration

With advances in technology, the radiation exposure dose during the lumbar examination using dual-energy CT with ASiR-V technique is equal to or lower than that with conventional CT (17,18,27). To further validate this, the exposure dosage data for all adults who underwent conventional CT lumbar examinations during July 2018 were retrospectively collected. The conventional CT imaging of the lumbar spine was performed on a 64-multidetector CT scanner (Brilliance, Philips Healthcare, Eindhoven, The Netherlands). The scanning parameters included: 64 ×0.625 mm detector collimation, 1 s rotation time, 0.798 pitch, and 120 kVp tube voltage with tube current modulation (Z-DOM).

A total of 89 consecutive adults (44 males, age: 51.0±14.2 years; 45 females, age: 51.6±16.5 years) were enrolled. The CTDIvol during the lumbar examination using conventional CT was 17.5±3.7 mGy (range, 11.5–28.3 mGy).

In our institution, the CTDIvol during lumbar examinations with dual-energy CT and ASiR-V technique (9.09 mGy) is lower than that of conventional CT (17.5±3.7 mGy). Therefore, we believe that there should be no great concern about the radiation exposure dose in our study.

Supplementary Material A3 Reproducibility and accuracy consideration of spinal QCT using different scanning protocols

The BDC phantom (QRM, Moehrendorf, Germany) was separately scanned 10 times without repositioning using two CT scanners (256-row GE Revolution; 64-row Philips Brilliance). The scanning protocol for the Revolution CT scanner was the same as that used *in vivo* in the present study. The scanning protocol for the Brilliance CT scanner was: 64 ×0.625 mm detector collimation, 1 s rotation time, 0.798 pitch, and 120 kVp tube voltage with 125 mA tube current.

The 70-keV monochromatic images of the Revolution CT scanner were used to measure the CT values of the phantom. Using the linear calibration described in this study, the adjusted predicted BMD of the inserts in the BDC phantom were used for further analysis. The adjusted predicted value for a case is the predicted value when that case is excluded from the calculation of the regression coefficients. Accuracy and reproducibility are described as relative error (RE) and coefficient of variation (CV), respectively (30,38).

The reproducibility and accuracy of spinal QCT were assessed, and the results are shown in *Table S1*. Our results indicated that the reproducibility and accuracy of spinal QCT using 70-keV monochromatic data were equal to those of conventional spinal QCT (39,40).

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